PARTNER WEBINAR

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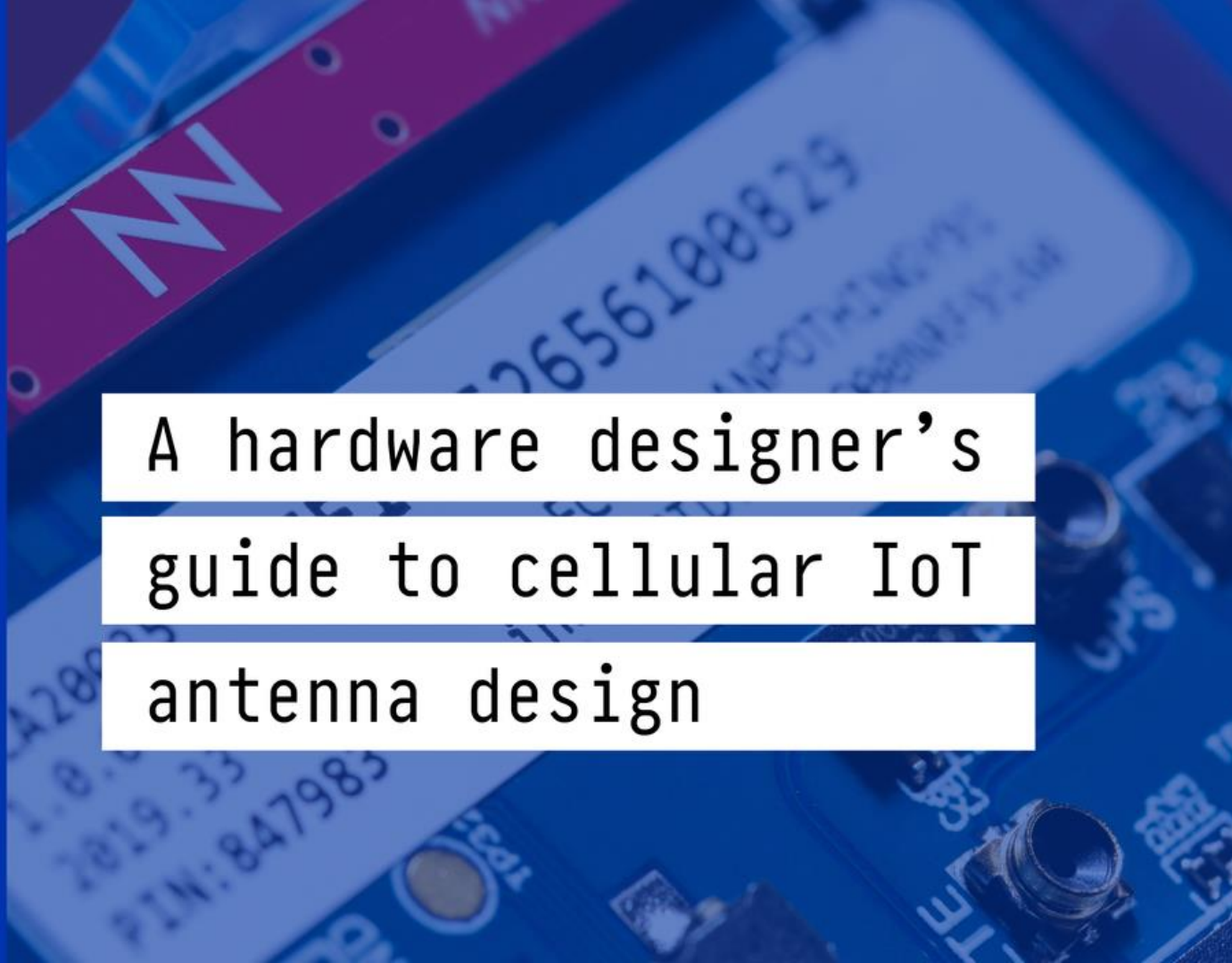
Your Innovation, Accelerated.

NORDICTECH WEBINARS

A hardware designer's guide to cellular IoT antenna design



Today's hosts

Dr. Jaume Anguera

CTO, Co-founder and lead inventor of Virtual Antenna™

ignion

Johan Pedersen

Senior Director Business Developer

ignion

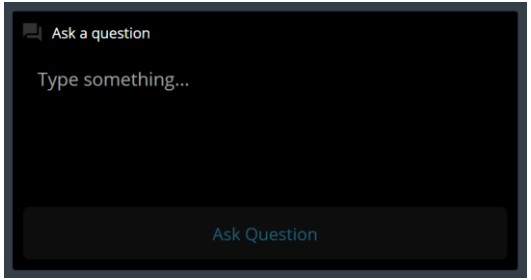
Martin Lesund

Technical Marketing Manager

NORDIC SEMICONDUCTOR

Practicalities

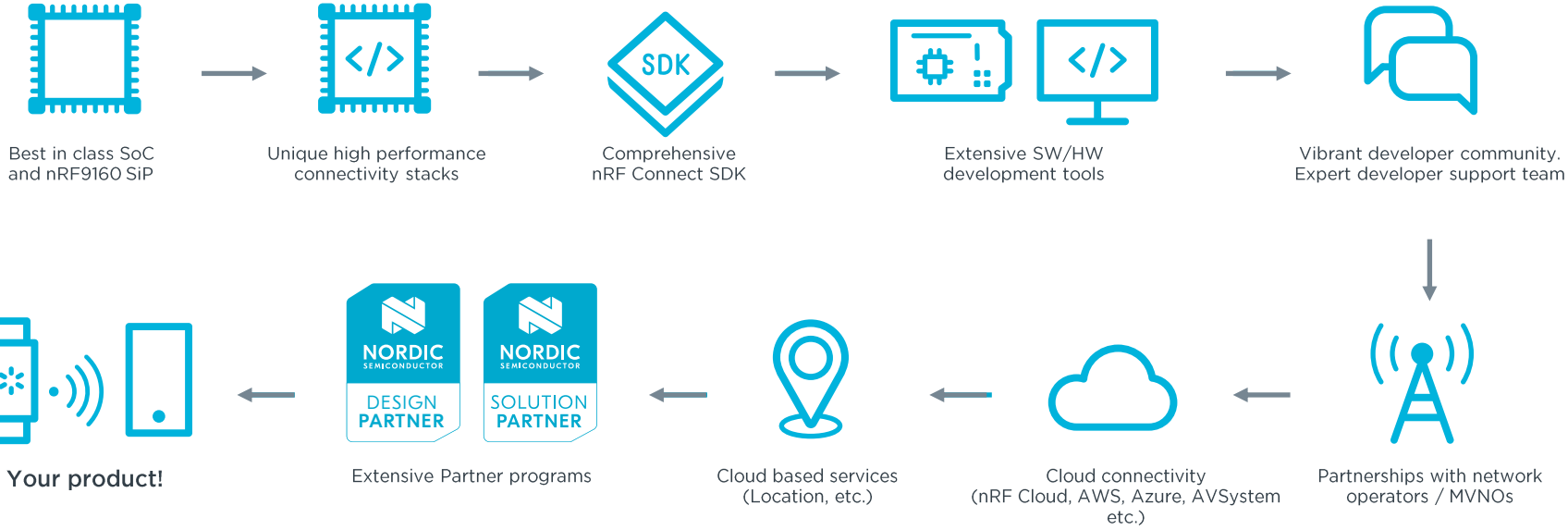
- Duration: 50-60 mins
- Questions are encouraged!
- Please type questions in the top of the right sidebar
  - All questions are anonymous
  - Try to keep them relevant to the topic
- We will answer questions towards the end
- The chat is not anonymous, and should **not** be used for questions
- If you have more questions:
  - Go to DevZone for Nordic related questions
- Antenna related: Ignion engineering support
- A recording of the webinar will be available together with the presentation at webinars.nordicsemi.com



{ DevZone

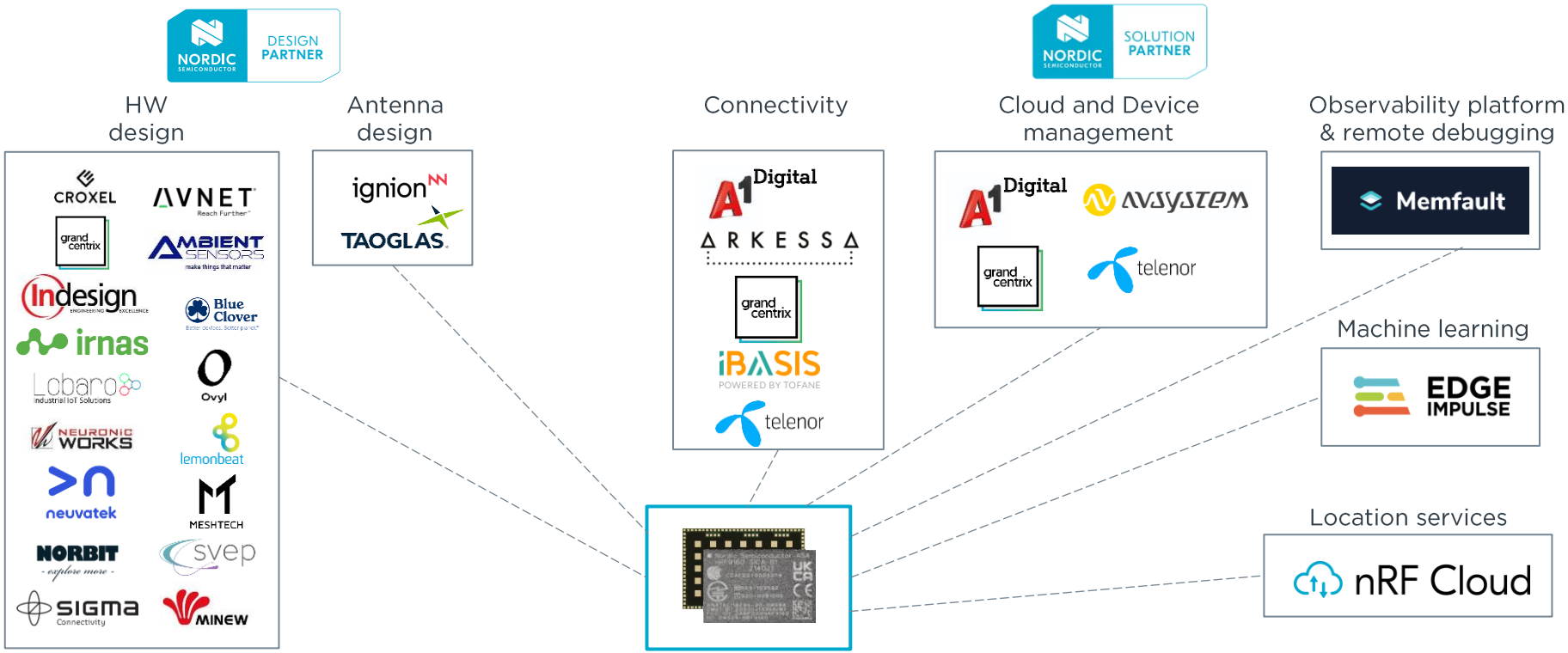
Solving the customer journey

From idea to finished product



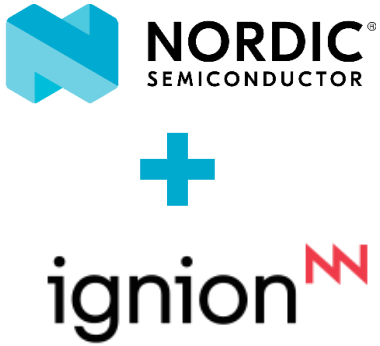
Nordic Partner Program

Simplify cellular with solutions optimized for Nordic technologies



Why Nordic and Ignion partner up

- Antenna is a crucial part of any wireless IoT design
- Antenna design can be difficult, and is often considered too late in the design process
- “Ease of use” is both in Nordics and Ignions vision
- Ignion provides a solid solution for Nordic customers



ignion NORDIC SEMICONDUCTOR

NORDIC SEMICONDUCTOR DESIGN PARTNER

NORDIC SEMICONDUCTOR SOLUTION PARTNER

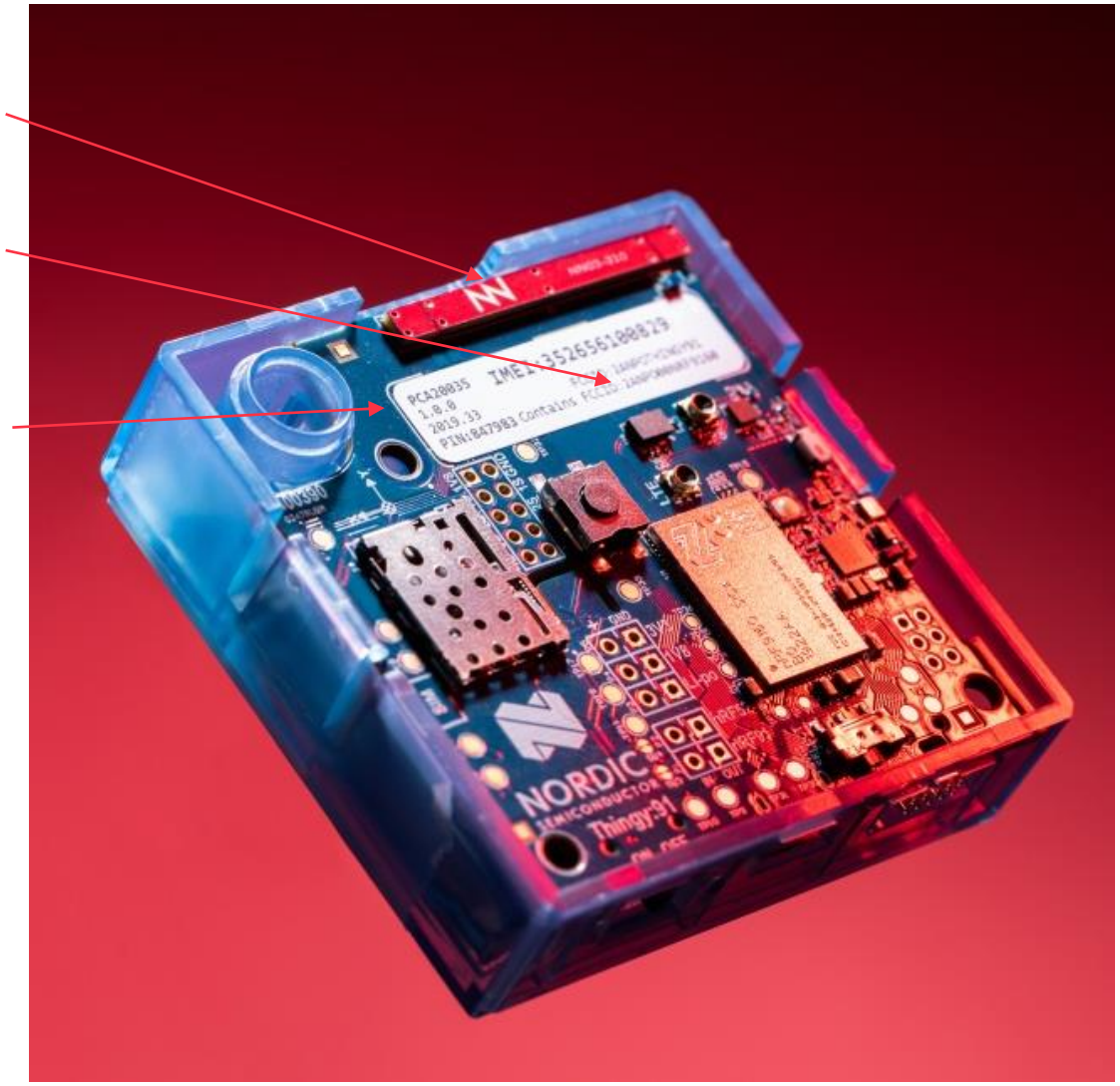
Your innovation. Accelerated.

Nordic & Ignion partnering on making RF easy

VIRTUAL ANTENNA®
LTE-M/NB-IoT and GPS with one antenna.

MATCHING NETWORK
to configure any band or protocol.

GROUND PLANE
delivering optimized RF performance.

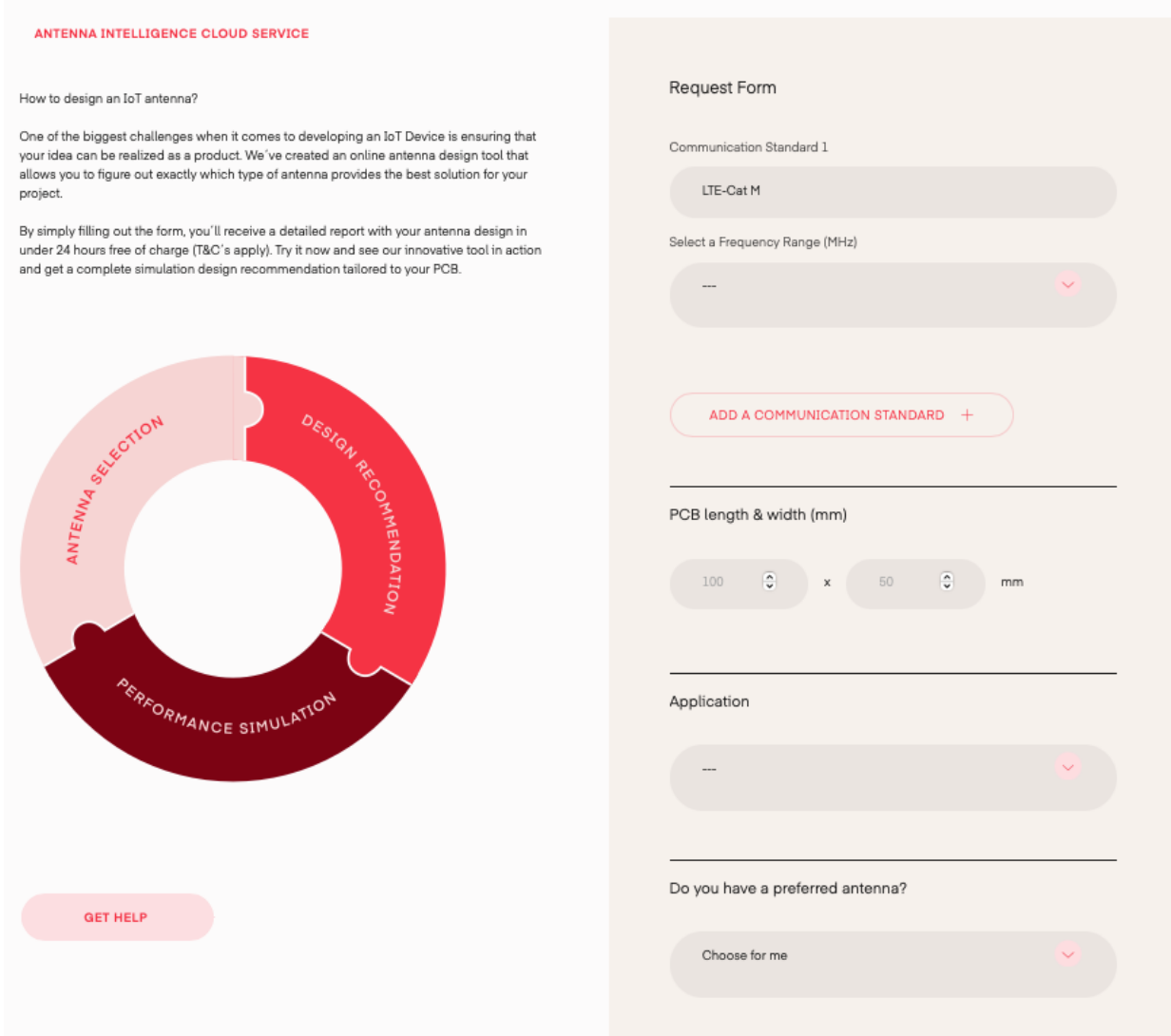


Ignion Virtual Antenna® technology

- Easy-to-use antenna solution delivering first time right.
- Market leading flexibility (698MHz-10GHz).
- Multiband & multiprotocol: different wireless protocols - in just one component.
- Long range & long battery life.
- First time through certification.
- Low lead times.

Live demo use of the Antenna Intelligence Cloud™

www.Ignion.io/nordic



Try the Antenna Intelligence Cloud tool and win!

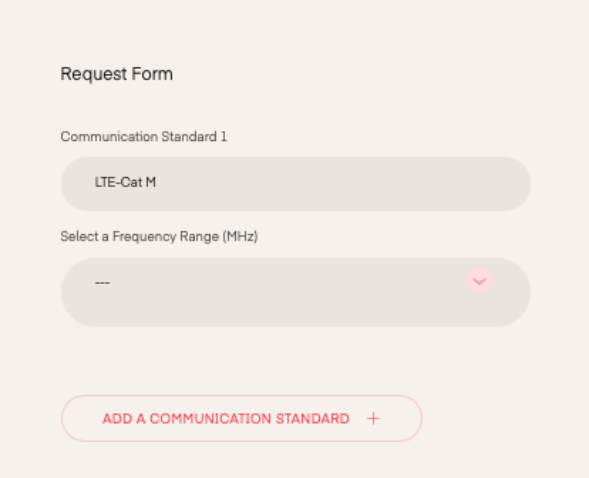
1

Go to

www.Ignion.io/nordic

2

Fill out the form



3

Get antenna design in 24 h

From all the submissions during this week of the webinar, we will draw a winner of:
Nordic Thingy 91 + 1 hour consultancy with Ignion antenna expert

POLL1: What is the most challenging part of antenna integration for cellular IoT?

a) Choosing the right antenna component

b) Integrating and tuning the antenna

c) Planning resources needed for the antenna

POLL2: What is the size of your IoT device? Longest PCB dimension

a) >10cm

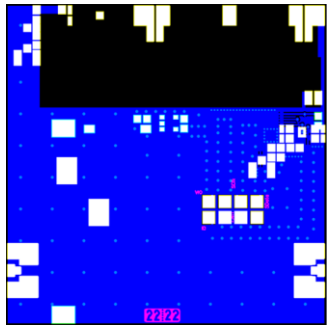
b) 5-10cm

c) <5cm

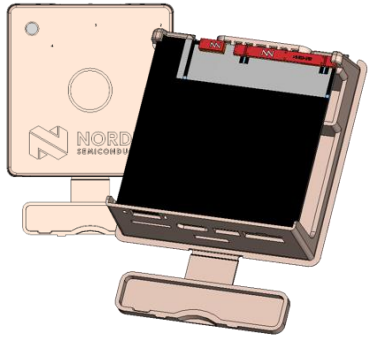
Cellular IoT Antenna Design Journey

1. FEASIBILITY
ANTENNA INTELLIGENCE CLOUD™

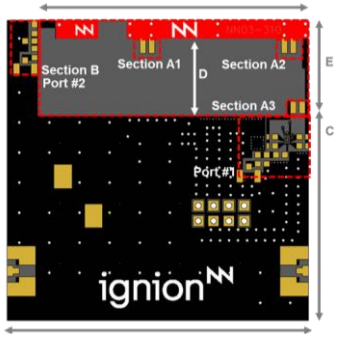
2. BUILD GERBER FILE
USE TEMPLATES



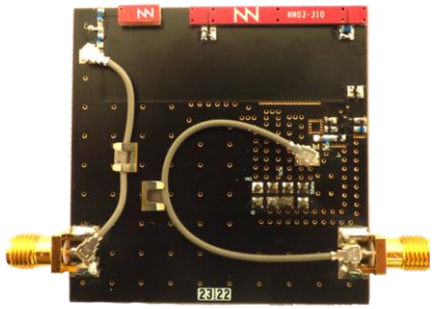
3. EM SIMULATION
MICROWAVE TOOLS



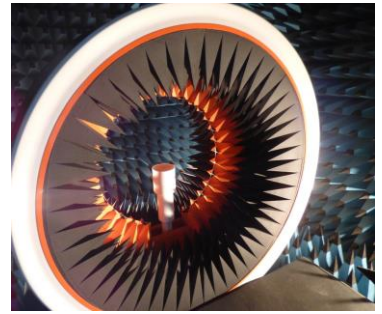
4. GERBER SANITY CHECK
IGNION SERVICE



5. PRODUCE PROTOTYPE
FINE-TUNE ANTENNA



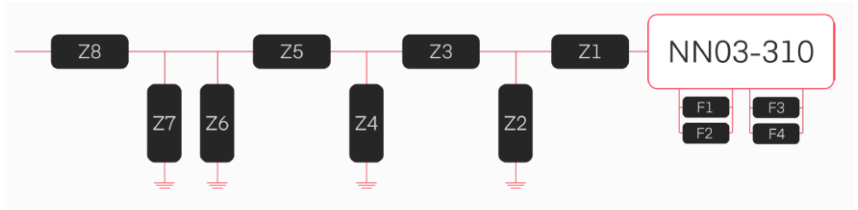
6. CERTIFICATION
PRE-CERTFICATION TEST



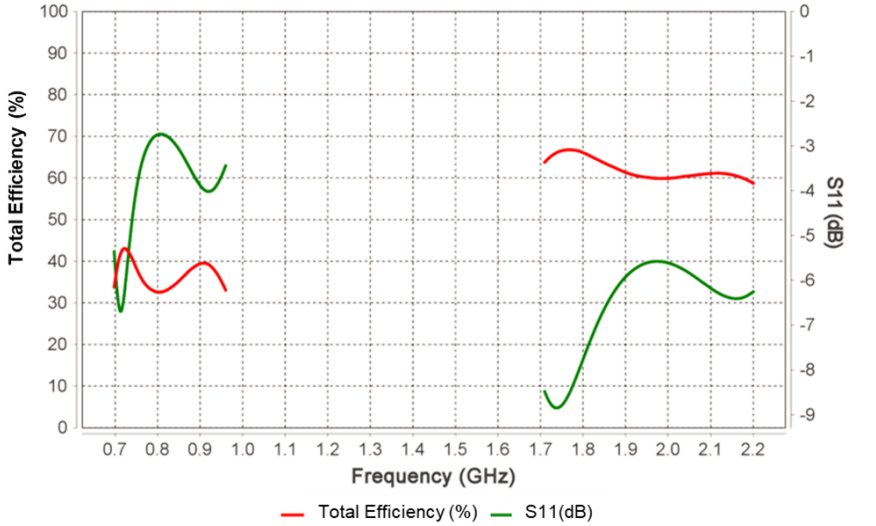
Feasibility
Use Antenna Intelligence Cloud ™ report

Antenna Selection & Location

Matching Network topology

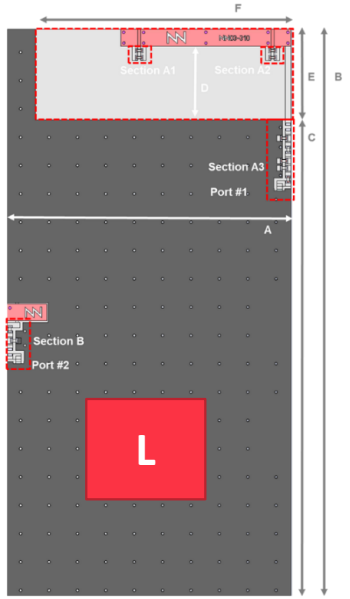


Return Loss & Efficiency

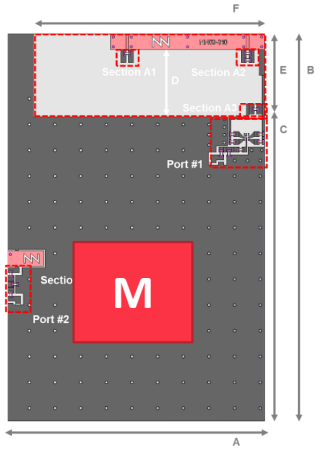


Feasibility
Evaluate PCB size influence on antenna performance

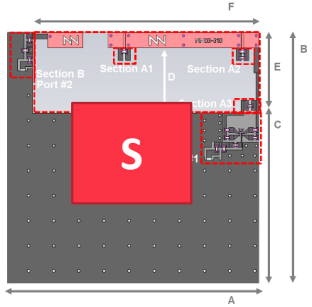
- Antenna efficiency is influenced by PCB dimensions
- Lower frequency bands are significantly reduced in smaller PCB sizes
- Keep size in mind when evaluating regional certification requirements



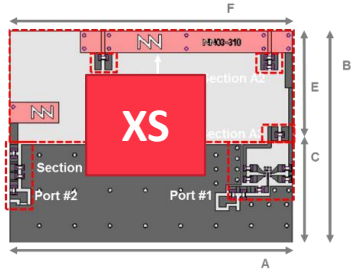
Size: 100 mm x 50 mm



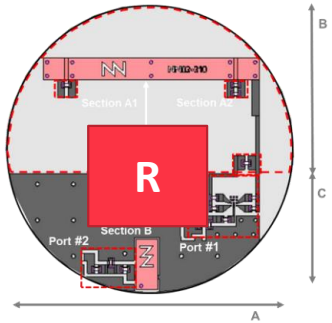
Size: 75 mm x 50 mm



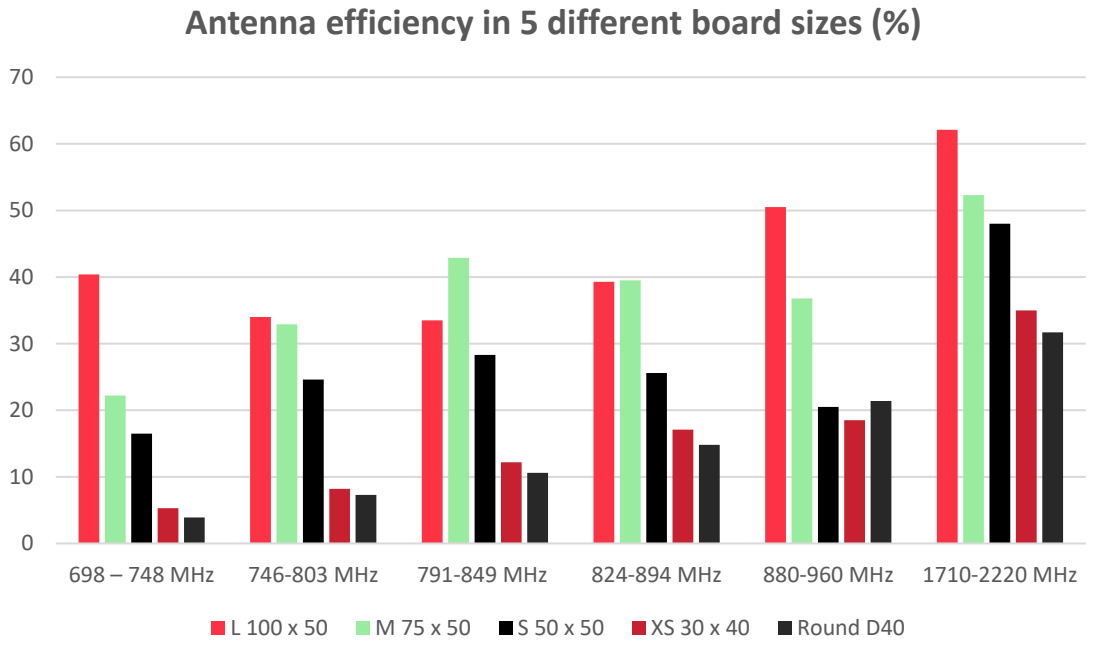
Size: 50 mm x 50 mm



Size: 30 mm x 40 mm



Size: 40 mm diameter

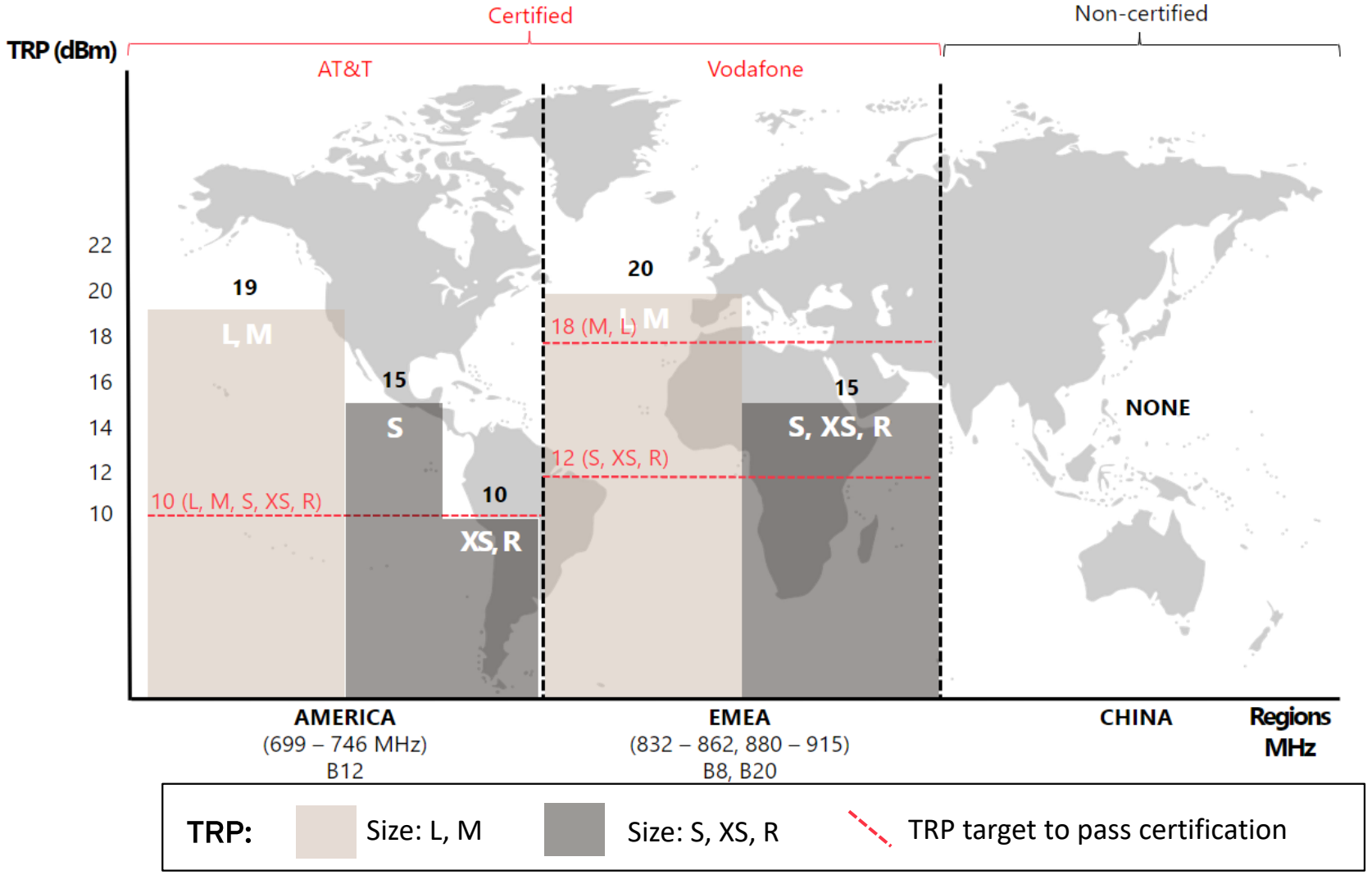


Feasibility

Check certification in low frequency bands

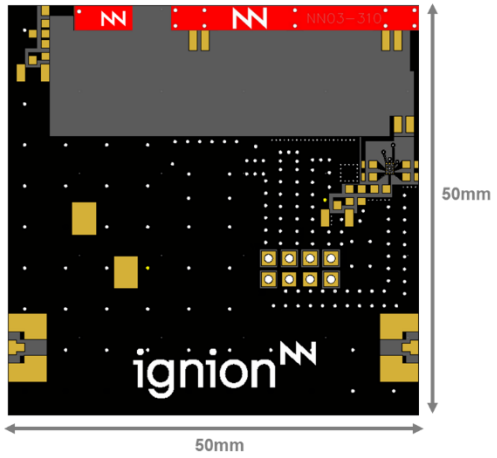
TRP (dBm) = [Estimated RF module Output power (dBm)] + [Total Efficiency (dB)]

5 board sizes and the estimated TRP

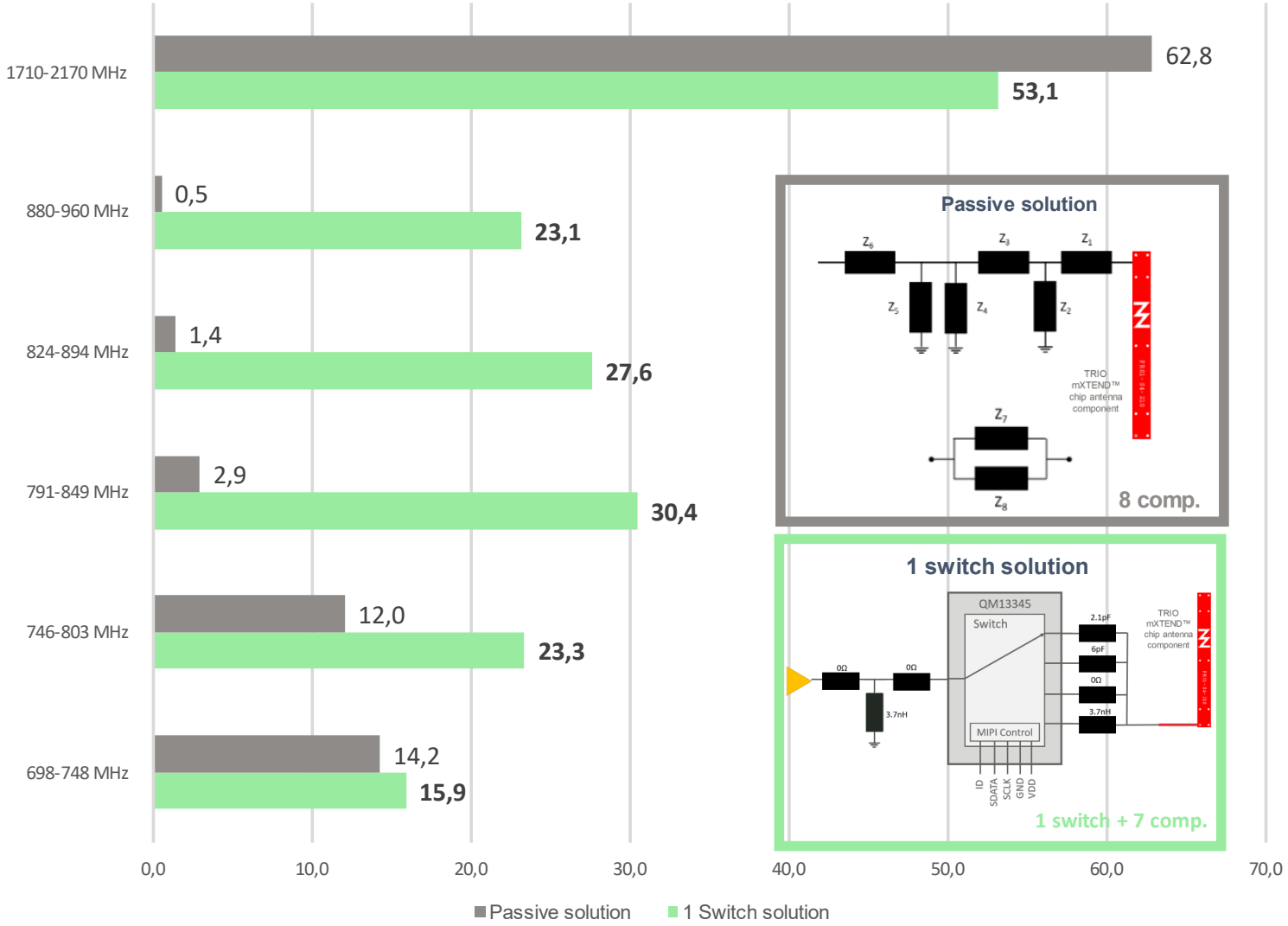


Passive versus active tunable matching network

- Rule of thumb: consider active matching network when PCB dimensions 50 x 50 mm or smaller



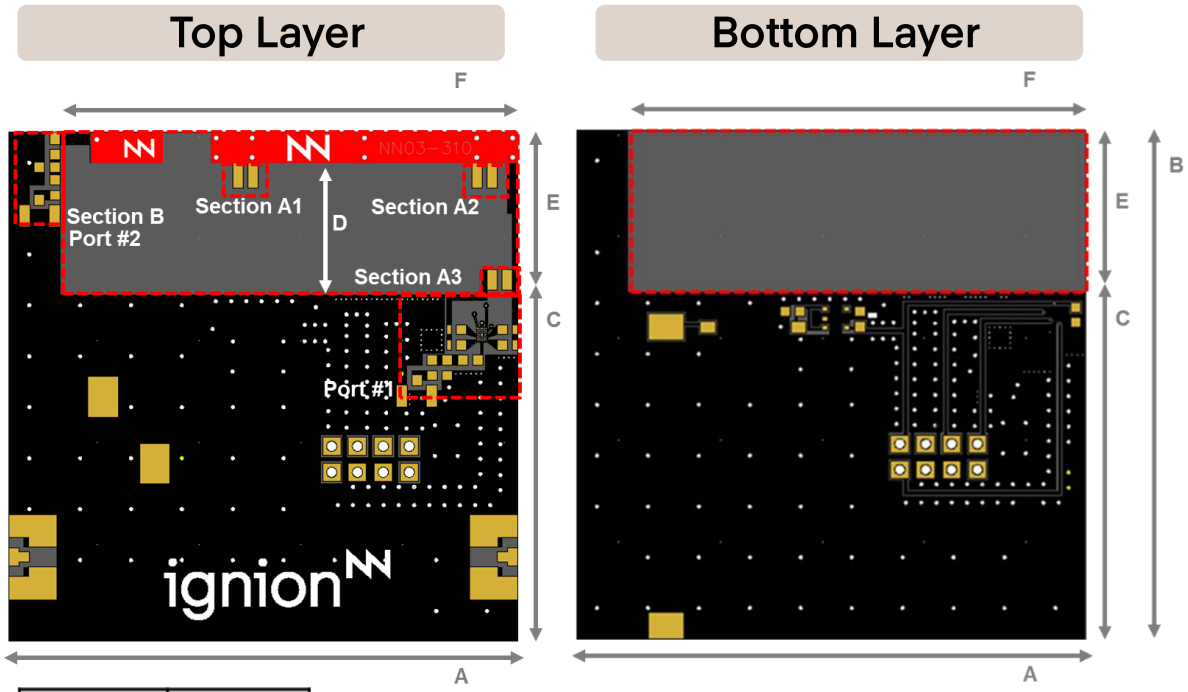
S size PCB (50 x 50 mm)



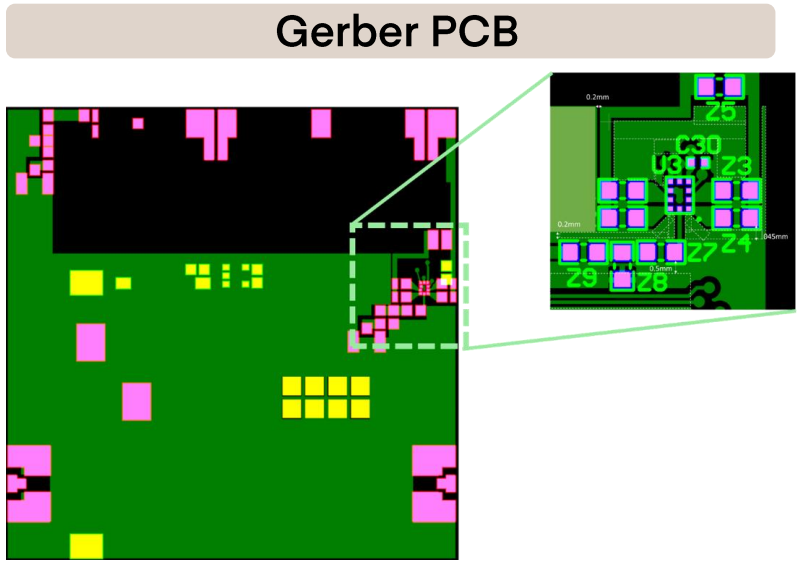
Antenna efficiency with active and passive matching network (50 x 50 mm PCB)

Gerber Build & Ignion Sanity Check

- Follow design recommendations from Antenna Intelligence Cloud™ report.
- Download our Design info pack to get the design templates
- Review the main design parameters from the antenna perspective:
  - Clearance area in all the layers of the PCB design
  - Antenna footprint & matching network topology and pad layout
  - Feeding line & transmission line to the RF module
  - Continuous ground plane layer in at least one layer of your design
  - Avoid metallic components near the antenna



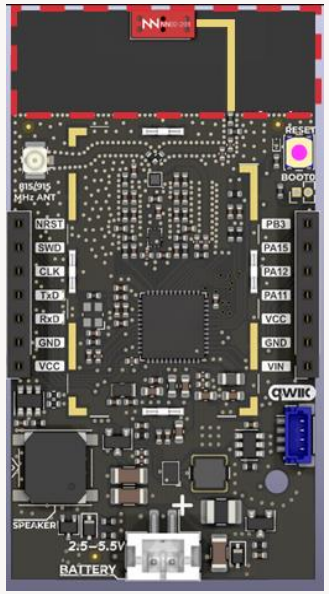
Measure	mm
A	50
B	50
C	34
D	13
E	16
F	45

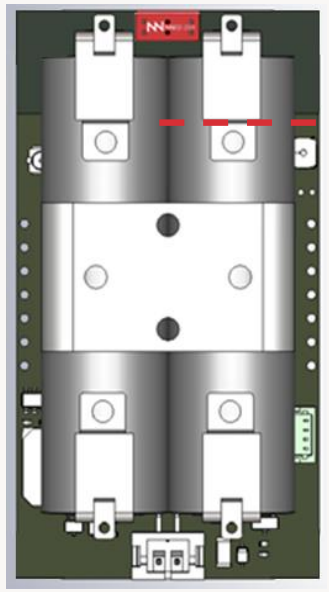


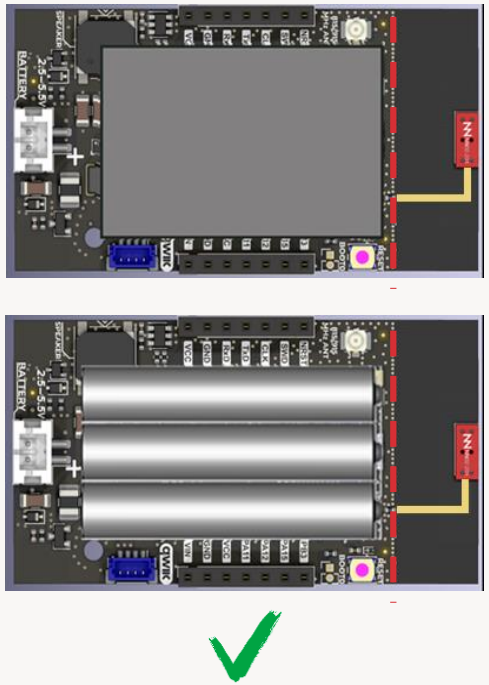
Typical mistakes when designing antenna for cellular

- Not considering influence of
  - Clearance area
  - Materials in proximity
  - Casing material
  - Battery placement
  - Metallic screws

The antenna needs a surface and volumetric clearance area in order to radiate properly.



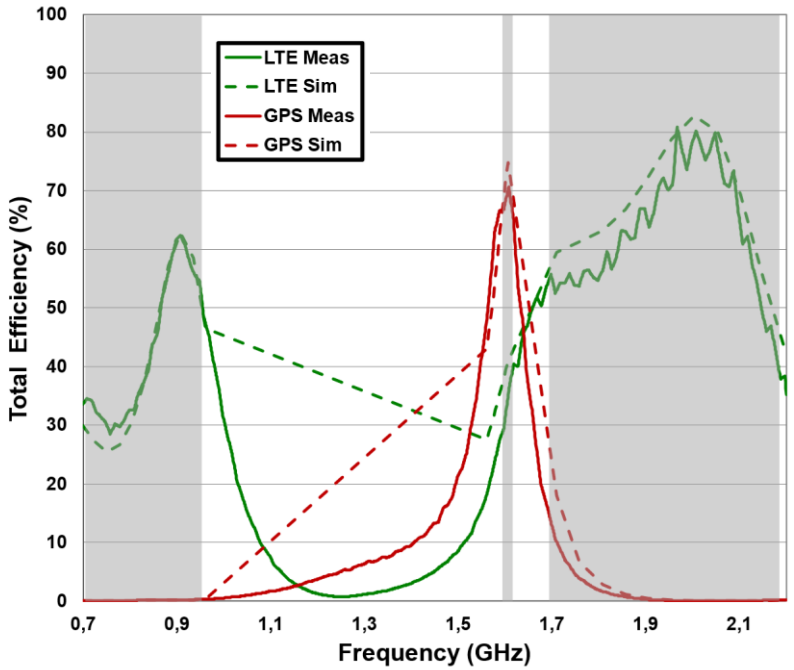




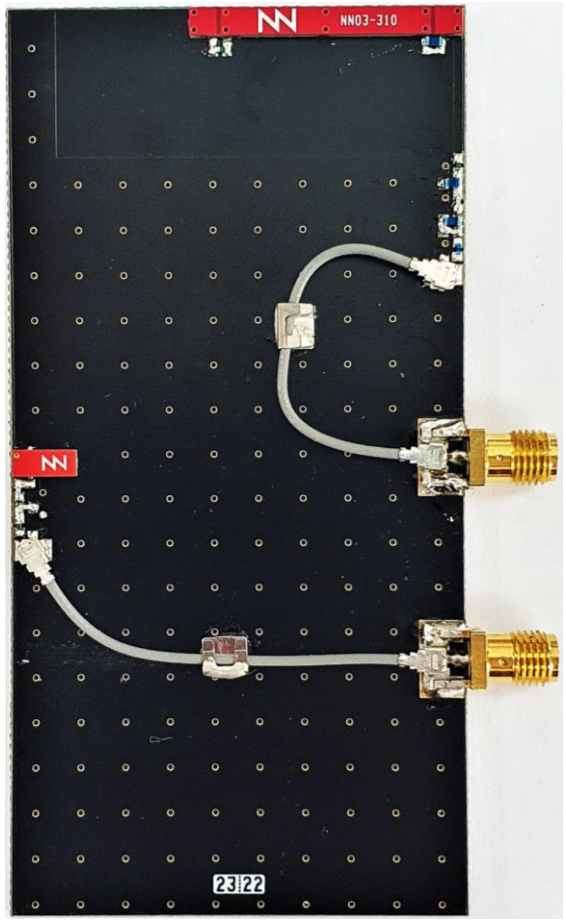
NEVER place batteries below the surface clearance area.

Testing Physical Prototype

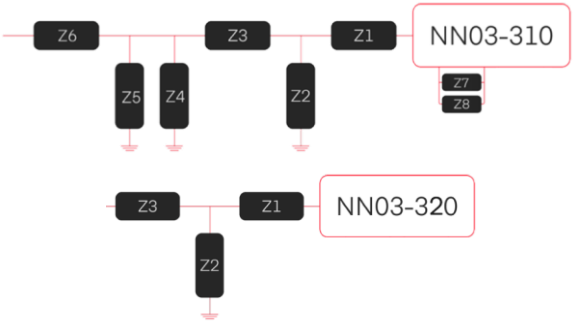
- Verify correct reflection coefficient with VNA
  - Fine tune matching network if needed
- Verify total efficiency in anechoic chamber



Measured total efficiency compared to simulated for L (100 x 50mm)



Prototype of L (100 x 50 mm)

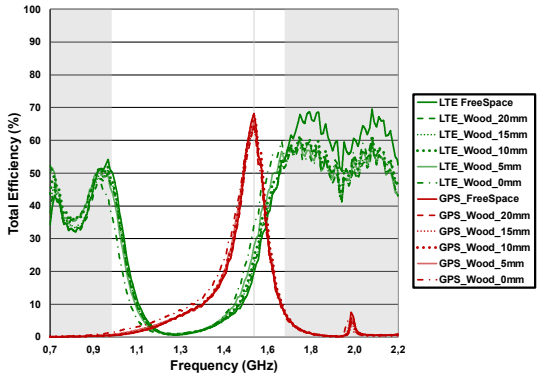


Components		Part Numbers	Values
Section A1	Open	Open	Open
Section A2	Z7	LQW18AN15NG80	15nH
	Z8	GJM1555C1HR30WB01	0.3pF
Section A3	Z1	-	0Ω
	Z2	LQW18AN9N1G80	9.1nH
	Z3	GJM1555C1H2R4WB01	2.4pF
	Z4	LQW18AN8N4G80	8.4nH
	Z5	GJM1555C1H1R9WB01	1.9pF
	Z6	LQW18AN4N1G80	4.1nH
Section B	Z1	GJM1555C1H1R3WB01	1.3pF
	Z2	GJM1555C1H5R0WB01	5.0pF
	Z8	-	0Ω

Matching network topology and component values of L (100 x 50 mm)

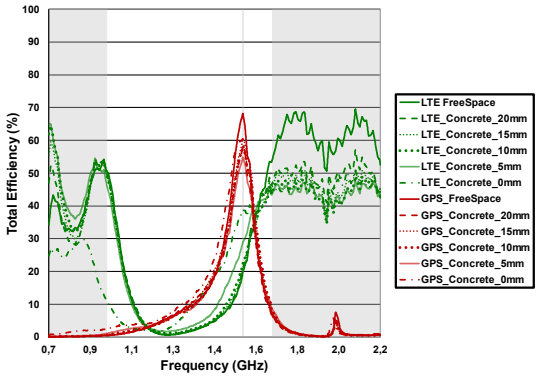
Materials in proximity – influence on antenna performance

WOOD



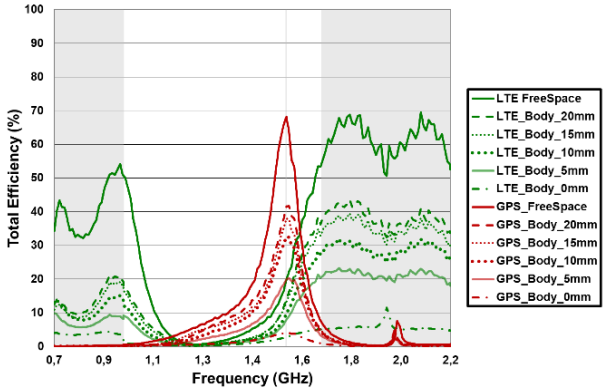
- **Ok to place device close to wood**

CONCRETE

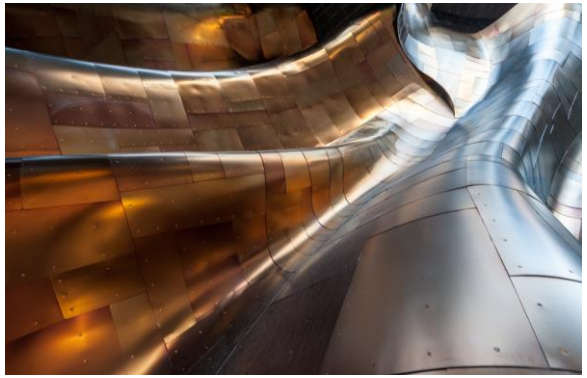


- **Keep some distance**

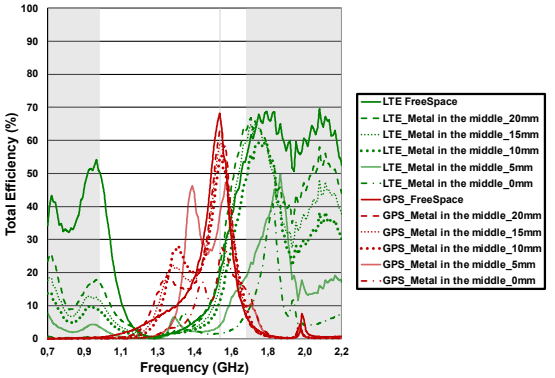
HUMAN/ANIMAL BODY



- **Locate placement with minimum body influence**



METAL



- **Keep metal at distance**
- **Re-tune matching if metal close**

Five different distances between the L size PCB (100 mm x 50 mm) and the surrounding material: 20mm, 15mm, 10mm, 5mm and 0mm have been analyzed. See design guide for more information.

Summary

Resources to support your antenna design journey

1. FEASIBILITY
ANTENNA INTELLIGENCE CLOUD™

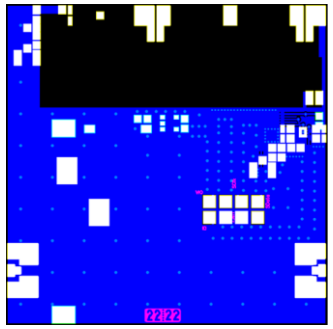
2. BUILD GERBER FILE
USE TEMPLATES

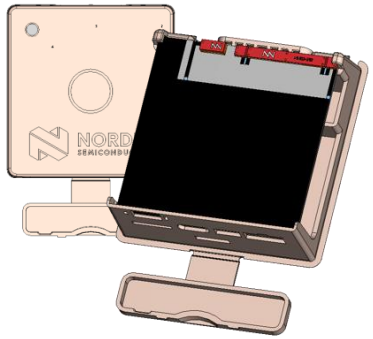
3. EM SIMULATION
MICROWAVE TOOLS

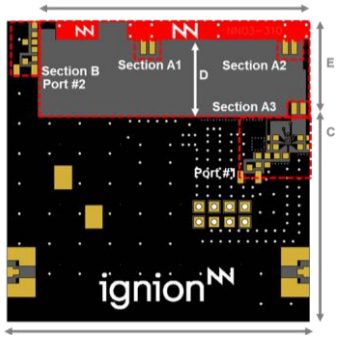
4. GERBER SANITY CHECK
IGNION SERVICE

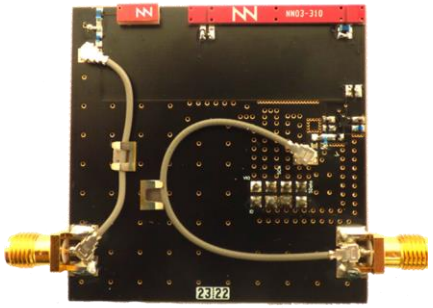
5. PRODUCE PROTOTYPE
FINE-TUNE ANTENNA

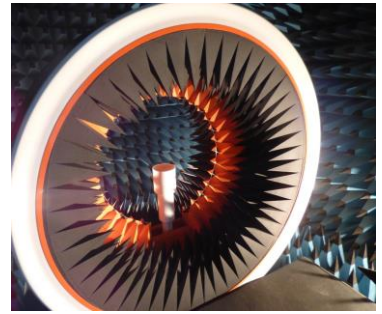
6. CERTIFICATION
PRE-CERTFICATION TEST











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How to easily get started with Nordic & Ignion

New Design Guide available from today

- **New Design Guide:**
  - Step by step Virtual Antenna® Design Journey Guide
    - Simulations
    - Building prototype
    - Lab measurements
    - Evaluating certification
  - PCB size influence on antenna performance
  - Materials in proximity influence on antenna performance

- Download on: https://ignion.io/landing-page/nordic-hw-design-guide/

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www.nordicsemi.com/webinars